

THERMAL INSULATING SHEET METAL PANEL WITH PHOTOVOLTAIC  
ELEMENT FOR A ROOF COVERING OR WALL CLADDING

The invention relates to a sheet metal panel for a roof covering or wall cladding, having two cover sheets and an intermediate layer of thermal insulating material.

Sheet metal panels of the kind specified, which are known in practice, act as closure elements for buildings and at the same time provide thermal insulation.

However, sheet metal sections without additional thermal insulation are also known in practice to whose outside a plane photovoltaic element is glued with a heat-sealing adhesive. The photovoltaic element is built up from a number of solar cells of amorphous silicon which are disposed one above the other and applied to a flexible supporting foil of special quality steel and covered by a protective plastics foil.

Such a sheet metal section is produced as follows: The photovoltaic element is applied to the sheet metal section lying flat and formed with holes for cables to be subsequently connected to rear side electric contacts of the photovoltaic element and the hot-sealing adhesive in foil form is applied as an intermediate layer, whereafter the hot-sealing adhesive is softened by heat introduced via the sheet metal section, the aforementioned three layers being subjected to pressure. After the hot-sealing adhesive has cooled, the photovoltaic element is connected over its whole surface to the sheet metal section..

It is an elaborate matter to produce such a sheet metal section with photovoltaic elements attached thereto by the hot-sealing adhesive, because of the joining and subjecting to pressure of said three layers laying flat one upon the other during the supply of heat via the sheet metal. More particularly, it is difficult to produce a connection of the metal section to the voltaic element is free from air inclusions.

Such a construction of a sheet metal section with a photovoltaic element attached thereto by a hot-sealing adhesive is unsuitable for thermal insulating sheet metal panels of the kind specified, since it is impossible to heat via the thermal insulating material of the intermediate layer the cover sheet, which forms the outside and to which the photovoltaic element must be connected, to a heat adequate for the hot-sealing process of normally approx. 120°C without at the same time destroying the thermal insulating material.

It is an object of the invention to provide a sheet metal panel of the kind specified which is provided with a photovoltaic element.

This problem is solved according to the invention by the features that applied to the cover plate of the panels forming the outside is a plane photovoltaic element which has electric connecting cables and which takes the form of a flexible laminate having a cold-bonding adhesive on its rear side and whose electric connecting cables extend through bores in the sheet metal panel, which are sealed with respect to physical constructional demands.

Preferably the photovoltaic element is formed by amorphous silicon cells. A suitable adhesive is, for example, a

bituminous layer. The bores with the connecting cables extending therethrough are preferably filled with a thermal insulating material technically optimised for fire protection. The bores in the cover sheet forming the underside must be provided with a closure acting as a vapour barrier.

An embodiment of the invention will now be explained in greater detail with reference to the drawing, which shows in cross-section a sheet metal panel with two photovoltaic elements and a part of a connected adjacent sheet metal panel.

Each sheet metal panel P, P\* comprises a cover sheet 1 which is internal in a roof covering or wall cladding, and an external cover sheet 2 which preferably forms wide beads 6, 7 by means of trapezoidal profilings 3, 4, 5. The two cover sheets 1, 2 enclose a cavity 8 which is closed laterally by closure strips 9, 10 and is filled with a thermal insulating material, for example, polyurethanes, polystyrene, mineral fibres, etc. The longitudinal edges 12, 13, 14, 15 of the cover sheets 1, 2 are so profiled differentially that adjacent sheet metal panels P, P\* partially overlap one another and engage positively in one another after the fashion of a tongue-and-groove connection. A sealing band 16 is inserted between the adjacent sheet metal panels P, P\*.

Photovoltaic elements 17, 18 are retained in the zone of the beads 6, 7 by means of a rearwardly applied cold-sealing adhesive 19, 20. Each photovoltaic element 17, 18 has two outwardly extending connecting cables 21, 22 of which only one is shown in the drawing for each photovoltaic element 17, 18. The connecting cables 21, 22 extend through the sheet metal panel via bores 23, which are also filled with a

thermal insulating filling material 25 technically optimised for fire protection. Outwardly the bores 23 are covered with a closure 26 acting as a vapour barrier.

The electrically interconnected units of each photovoltaic element 17, 18 consist of a number of amorphous silicon cells which are disposed one above the other and covered on the outside by a protective plastics layer, thereby forming a flexible laminate. The laminate is provided on the rear side with the cold-sealing adhesive 19, 20, more particularly an adhesive on a bitumen basis. The laminate is supplied to the manufacturer of the sheet metal panels in the form of webs, the self-adhesive bitumen layer being covered by a readily removable separating paper. The manufacturer of the sheet metal panels then moves the connecting cables 21, 22 up to the electric connections of the photovoltaic elements 17, 18, so that when the laminate is rolled on to the sheet metal panel P he can take the connecting cables 21, 22 through the bores 23. The bores are then filled with thermal insulating material 25 technically optimised for fire protection and the closures 26 are applied.